UNITED STATES DEPARTMENT OF AGRICULTURE

BUREAU OF ENTOMOLOGY AND PLANT QUARANTINE

Project	Date	Author

TITLE

OBSERVATIONS ON AN OUTBREAK OF THE BLACK - HEADED BUDWORM IN THE STATE OF WASHINGTON - SEASON OF 1944

by

R. L. Furniss

Forest Insect Laboratory
445 U. S. Court House
Portland 5, Oregon
August 31, 1944

SUBJECT—

INDEX NO.—

U.S. GOVERNMENT PRINTING OFFICE 8—0742

OBSERVATIONS ON AN OUTBREAK OF THE BLACK - HEADED BUDWORM IN THE STATE OF WASHINGTON - SEASON OF 1944

by

R. L. Furniss

Forest Insect Laboratory
445 U. S. Court House
Portland 5, Oregon
August 31, 1944

CONTENTS

INTRODUCTION

In 1944 an outbreak of the black-headed budworm, Acleris variana Fernald (formerly known as Peronea variana), became prevalent on the Olympic Peninsula and elsewhere along the Washington coast. It is the purpose of this report to record what is known regarding the extent and intensity of the outbreak, to reiterate a few of the known facts about the insect, and to forecast if possible what its effects will be upon the infested stands. A more detailed report will subsequently be prepared on the entomological aspects of the outbreak.

SURVEY OF 1944

On July 23 the writer made a general reconnaissance that indicated the widespread nature of the outbreak. The findings were reported to the National Park Service and the U. S. Forest Service in a brief memorandum dated July 29. A much more detailed survey was made during the period August 15 to 22. During the latter period Furniss was greatly aided by Sanford M. Floe of the U. S. Forest Service, William C. Gross of the State Division of Forestry, C. H. Willison, Jr. of the Crown Zellerbach Corporation, and William J. Snider of Rayonier Incorporated. On August 18, Floe, Willison, and Furniss made an aerial survey of part of the infested area in a Coast Guard plane flown by Lieutenant J. A. Palmer.

The area involved was so great that, with the time and personnel available, only generalized information could be obtained. Most of the survey work was done by traversing roads and by making observations from high points, a time consuming procedure of limited effectiveness. Fog and low lying clouds hampered this work to a considerable extent. The ground work was supplemented on August 18 by an aerial survey of two and one-half hours duration. This aerial reconnaissance was by all odds the most satisfactory method of determining the extent of infestation, but its effectiveness was diminished by adverse weather conditions and lack of time for full coverage. From two to three days of flying time would have been required to give a complete picture of the outbreak.

DISCUSSION OF THE OUTBREAK

History: First indications of an outbreak were noted in August 1943 when the National Park Service reported defoliation of western hemlock in the vicinity of Soleduck Hot Springs and Olympic Hot Springs in Olympic National Park. Insect specimens associated with this defoliation were identified as the black-headed budworm. In May 1944 a

local spot of defoliated hemlock was observed in Township 10 North, Range 10 West in Pacific County. Subsequently, this defoliation, which had occurred in 1943, was found to have been caused by the budworm. These meager records constitute what is known of the early history of the outbreak.

In 1944, infestation increased greatly, and by late July and early August had developed to the point that defoliation was conspicuous over a large area, particularly on the northern and northwestern sections of the Olympic Peninsula. This defoliation aroused concern as to the insect involved and the damage it might cause to the affected stands. The situation was brought to the attention of the Bureau of Entomology and Plant Quarantine by various public agencies and timber owners with the request that the outbreak be studied to determine what, if any, control measures are needed.

Trees affected: On the area now infested in the State of Washington, western hemlock (Tsuga heterophylla) is undoubtedly the preferred host. Pacific silver fir (Abies amabilis) is also heavily attacked. Incidental feeding has been observed on Sitka spruce (Picea sitchensis), alpine fir (Abies lasiocarpa), and Douglas-fir (Pseudotsuga taxifolia). So far, only western hemlock and Pacific silver fir have been attacked sufficiently to cause any alarm. In this report the discussion is confined to a consideration of infestation on western hemlock.

Mature trees, second growth, and understory trees are all readily attacked by the budworm. Of these, the understory trees are most heavily defoliated because they are doubly affected, first by larvae that develop on them directly and second by larvae that drop on them from the overstory.

Extent and degree of infestation: The indications are that the budworm is abnormally abundant wherever hemlock occurs in the northern and western parts of the Olympic Peninsula and also southward along the coast to the Columbia River. Reports from the National Park Service indicate that it is likewise prevalent along the eastern slopes of the Olympics at least as far south as Lake Cushman. Within this very large area most of the infestation may be classed as light and shows up as a definite, but not conspicuous, browning of the new foliage. This type of infestation would not be noted by the casual observer and would not be of importance except that it shows the area on which the outbreak might develop to epidemic proportions.

Within the general area of infestation there are numerous centers where defoliation is much more pronounced and infestation can already be considered as epidemic. The principal centers, so far discovered, are plotted on the accompanying infestation map. Three degrees of infestation are shown. The lightest of these is classed as "moderate" and is about the minimum that shows up to good advantage from the air. Roughly, these trees are ones that have lost a considerable part of the new foliage, especially in the tops. "Heavy" infestation refers to trees that have lost most of their new foliage and some of the old. The designation "very heavy" refers to areas on which the trees have been nearly completely defoliated.

It is felt that the area of "moderate" defoliation considerably exceeds that shown on the map. For example, infestation of second growth along Highway 101 for much of the distance from Lake Crescent to Sappho could easily be classed as "moderate" as shown by the ground survey. Infestation on this area did not show up well from the air, probably because of poor lighting; hence, it is not shown on the map. Very likely there were other areas of a similar nature.

Of particular interest to note is the fact that the centers of heavy infestation in 1944 approximate the area that Jaenicke[1] found to be heavily infested by the budworm in 1929, see attached map for comparison. From this, it is surmised that there may be some peculiar local conditions, perhaps climatic in nature, which periodically favor increase of the budworm in this particular vicinity. Of particular interest also is the fact that infestation within a half mile or so of the coast is conspicuously heavier than for a considerable distance further inland.

Present condition of the trees: It is too early to determine with certainty whether any of the attacked trees will succumb. On the basis of what has taken place so far it is anticipated that mortality, if any does occur, will be among the understory trees and perhaps on the areas mapped as "very heavy." One encouraging feature is that on trees where feeding was completed fairly early in the season growth of foliage has continued and by the third week in August tended to obscure the effects of defoliation. This seemed especially true of trees that were lightly or moderately attacked.

---

[1] Jaenicke, A. J., The Western Hemlock Defoliation in the Olympic Peninsula, Washington, July 1929.
Office Report, U. S. Forest Service, August 1, 1929

Fire hazard: A feature of special significance with regard to attacks by the budworm is that heavy feeding produces a rather serious fire hazard. This is brought about by the dead needles remaining attached by webs to the affected trees. Hazard from this source is high from the last of July until about the end of August or until such time as the dead needles are removed from the trees by the elements. Should the infestation continue at a high level next season, it would be well to take this special situation into consideration insofar as fire suppression plans are concerned.

THE INSECT AND ITS HABITS

Identity: One of the first questions that is asked when a defoliator outbreak occurs on hemlock in the Pacific Northwest is whether the responsible insect is the hemlock looper. It is considered relatively good fortune when, as in this case, the insect turns out to be the black-headed budworm. The two can be readily distinguished in all stages. Larvae of the hemlock looper are brown with diamond-shaped markings on the back and are from 1¼ to 1½ inches long when full grown. They crawl in characteristic inch-worm or looper fashion. Adults of the looper are light buff and have a wing expanse of about 1½ inches. Pupae are mottled greenish brown. In contrast, black-headed budworm larvae are uniformly yellowish green to bright green with black or brown heads. At maturity, they scarcely exceed ½ inch in length. They feed nearly concealed in flimsy silken tubes among the needles and wriggle violently either forward or backward when disturbed, but they do not "loop". Budworm adults are varicolored moths with an over-all width of about 5/8 of an inch. Pupae are uniformly greenish brown. The black-headed budworm is also distinct from the spruce budworm, a rather close relative that is especially destructive to spruce and fir stands in the eastern United States and Canada.

Stages and life cycle: Briefly, the life cycle of the black-headed budworm is as follows: The small varicolored moths deposit their eggs in August and early September on the lower surface of the needles. These eggs overwinter and hatch the following spring about when the buds begin to open. The young larvae are yellowish green with black heads. As they develop, their body becomes bright green and the head dark brown. Feeding is within silken tubes that the larvae construct by webbing the needles together. First the unfolding foliage is attacked, then the fully formed new needles, and in cases of heavy infestation, the old needles. Heaviest feeding is concentrated in

the tops of trees. In the main, feeding is completed by early August and the larvae transform into greenish brown pupae within their webs upon the twigs. The adults emerge in August and September to complete the one year life cycle.

CONTROL

Natural: The black-headed budworm is host to a large variety of insect parasites, several insect predators, and one or more diseases. These factors apparently keep the budworm in check most of the time and are expected to bring about the decline of the outbreak now in progress.

Rearings show a high degree of parasitism on all areas where collections have been made but especially on areas where infestation is known to have been present in 1943. Wilt disease that affects the large larvae and pupae is also prevalent. Despite these controlling factors the budworm population as it reached the adult stage in August 1944 was still highly epidemic.

Artificial: The only possible method of applying artificial control is by airplane. However, numerous technical details as to equipment, insecticides, and timing would have to be worked out before any wholesale project could be undertaken with any assurance of success. Such a project would be very costly and, in the light of present infestation and what is now known as to the destructiveness of the budworm, would not be justified. In order to be on the safe side, steps should be taken to work out the details of artificial control in case the need should develop before the outbreak subsides.

FORECAST

It is not possible to prophecy with certainty what the course of this outbreak will be. If the past record of the budworm on the Pacific Coast can be considered a reliable criterion, there seems to be little to worry about, for such widespread epidemics as that of 1929-30 in the northern Olympics subsided without doing appreciable damage.

Very little mortality is anticipated from the defoliation that has occurred so far. Should heavy infestation continue for another year or two on the areas where defoliation is now classed as "heavy" or "very heavy," considerable mortality is quite likely to occur.

Population studies show a high degree of parasitism and the prevalence of disease, but despite these controlling agents, the budworm population reached the adult stage in vast numbers in 1944 and the indications are that the outbreak will continue to develop next season.

All this adds up to the fact that the ultimate effects of this outbreak remain in doubt.

RECOMMENDATIONS

(1) No direct control is necessary at this particular stage. Infestation, although of epidemic proportions, does not warrant suppression measures and in any event it is now too late in the season to apply effective control.

(2) As soon as brood development gets under way next season, population studies should be resumed in order to determine in advance what may be expected of the late feeding stages which do most of the damage. These studies of the budworm and the factors affecting its abundance are considered to be a responsibility of the Bureau of Entomology and Plant Quarantine.

(3) Should the infestation continue to develop and the need for control become acute, airplane dusting or spraying would be the only feasible means of control. Such treatment is costly, hazardous, and still in the trial and error stage. Nevertheless, it is considered advisable to determine whether suitable equipment and adequate materials would be available should the need for them develop.

(4) Since no specific information is at hand regarding control of this insect, it is recommended that experimental work be undertaken to determine what insecticides are effective, and also when and how they can be best applied. This work, a basic preliminary to any control program, can be done in conjunction with the population studies.

(5) A more comprehensive and detailed survey will be needed next season. On the basis of this year's experience, it is evident that such a survey can best be made by aerial reconnaissance. Two or three full days of flying in good weather should provide all the information that is necessary. Preferably the survey should be made about the first week of August when color differentiation of the attacked trees is most evident. The survey is a project requiring the cooperation of timber owners, the land managing agencies, and the Bureau of Entomology and Plant Quarantine.

MAP SHOWING EXTENT AND INTENSITY OF DEFOLIATION BY THE BLACK-HEADED BUDWORM, ACLERIS VARIANA (FERN)-AUGUST 1944

LEGEND

- Moderate defoliation
- Heavy defoliation
- Very heavy defoliation
- Collection point
- Boundary of heavily defoliated area of 1929

U. S. DEPARTMENT OF AGRICULTURE
FOREST SERVICE
EARLE H. CLAPP, ACTING CHIEF
T. W. NORCROSS, CHIEF, DIVISION OF ENGINEERING

OLYMPIC NATIONAL FOREST
WASHINGTON
WILLAMETTE MERIDIAN
1942

Scale 1 0 1 2 3 4 5 Miles

LEGEND

- National Forest Boundary
- Good Motor Road
- Poor Motor Road
- Trail
- Railroad
- Telephone Line
- Telephone Line along Road
- Telephone Line along Trail
- House, Cabin, or Other Building
- Township or Section Corners recovered
- Supervisor's Headquarters
- District Ranger Station
- Guard or Ranger Station not permanently occupied
- Permanent Lookout Station
- Triangulation Station and Permanent Lookout Station
- Triangulation Station and Emergency Lookout Point
- Triangulation Station
- Improved Recreation Area

RELATIVE ACCURACY DIAGRAM

Very good to good — Fair to unknown

Traced from 1941 Olympic 3-Color Topographic Map, with additions and revisions to Apr. 1942 by V.A.B. Portland, Oregon.

Polyconic projection 1927 North American datum

Longitude west from Greenwich

INFESTATION MAP